The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A totally implantable nerve stimulation system, comprising:

one or more nerve cuffs having electrodes therein that contact a nerve or nerves;

an event-triggered, closed-loop control unit that is connected to receive signals from at least one electrode in a nerve cuff and to deliver stimulation pulses to at least one electrode in order to produce a desired physiological response, the closed-loop control unit including:

an internal electrical power source;

a processor;

a number of signal conditioning circuits;

a programmable switch controlled by the processor to connect an electrode to a signal conditioning circuit;

at least one stimulation circuit that delivers a stimulation pulse to one or more of the electrodes;

wherein the processor selectively enables the number of signal conditioning circuits, the programmable switch and the at least one stimulation circuit to lengthen the life of the electrical power source.

2. The implantable nerve stimulation system of Claim 1, wherein the signal conditioning circuits include:

a low input current amplifier;

a rectifier circuit; and

an integrator circuit.

3. The implantable nerve stimulation system of Claim 2, wherein the nerve stimulation system stimulates nerve fibers to treat foot drop and wherein the processor receives output signals from the number of signal conditioning circuits to detect the occurrence of a heel contact or toe lift event.

4. The implantable nerve stimulation system of Claim 3, wherein the processor delivers at least one stimulation pulse to an electrode upon detection of a toe lift event.

5. The implantable nerve stimulation system of Claim 4, wherein the processor disables the number of signal conditioning circuits during at least a portion of the time when the stimulation pulse is delivered.

6. The implantable nerve stimulation circuit of Claim 1, wherein the closed-loop control unit includes an accelerometer that produces a signal indicative of an orientation of a patient's thigh, wherein the processor disables components of the closed-loop control unit when the patient's thigh is substantially horizontal.

7. The implantable nerve stimulation circuit of Claim 6, wherein the processor adjusts the stimulation pulses delivered as a function of the angle of the patient's thigh.

8. A fully implantable nerve stimulation system for treating foot drop, comprising:

one or more nerve cuffs having electrodes therein that detect signals from and/or deliver stimulation pulses to a nerve fiber;

a sealed closed-loop control unit that is implantable in a patient, the closed-loop control unit including:

an electrical power source;

a processor;

one or more signal conditioning circuits that are selectively coupled to an electrode in a nerve cuff; and

one or more stimulation circuits that deliver stimulation pulses to an electrode;

wherein the processor detects the occurrence of a heel contact or toe lift event by filtering the output signals produced by the one or more signal conditioning circuits

9. A fully implantable nerve stimulation system for treating foot drop, comprising:

one or more nerve cuffs having electrodes therein that detect signals from and/or deliver stimulation pulses to a nerve;

a sealed closed-loop control unit that is implantable in a patient, the closed-loop control unit including:

an electrical power source;

a processor;

one or more signal conditioning circuits that are selectively coupled to an electrode in a nerve cuff; and

one or more stimulation circuits that deliver stimulation pulses to an electrode;

wherein the processor detects the occurrence of a heel contact or toe lift event by filtering the output signals produced by the one or more signal conditioning circuits and comparing the filtered output signals with the unfiltered output signals to detect a rising or falling ramp in the output signals and wherein the processor causes at least one stimulation pulse to be delivered to an electrode upon detection of a toe lift event.

10. The fully implantable nerve stimulation system for treating foot drop of Claim 9, wherein the closed-loop control unit includes an accelerometer in communication with the processor, the accelerometer producing a signal indicative of the angle of a patient's thigh, and wherein the processor adjusts the stimulation signals delivered in response to the angle of the patient's thigh.

11. The fully implantable nerve stimulation system for treating foot drop of Claim 10, wherein the processor terminates the delivery of the stimulation pulse upon detection of a heel contact event if the patient's thigh angle indicates the patient is walking on a relatively flat surface.

12. The fully implantable nerve stimulation system for treating foot drop of Claim 10, wherein the processor terminates the delivery of the stimulation pulse upon detection of a second toe lift event if the patient's thigh angle indicates the patient is walking on a stair.

13. The fully implantable nerve stimulation system for treating foot drop of Claim 12, wherein the processor increases the magnitude of the stimulation pulse delivered if the patient's thigh angle indicates the patient is walking up a stair.

14. The fully implantable nerve stimulation system of Claim 12, wherein the processor decreases the magnitude of the stimulation pulse delivered if the patient's thigh angle indicates that the patient is walking down a stair.

15. The fully implantable nerve stimulation system of Claim 10, wherein the processor reduces the power drawn from the electrical power source if the angle of the patient's thigh indicates the patient is not standing.

16. The fully implantable nerve stimulation system of Claim 9, wherein the one or more nerve cuff include a nerve cuff placed around the tibial nerve and a nerve cuff placed around the common peroneal nerve.

17. The fully implantable nerve stimulation system of Claim 9, wherein the one or more nerve cuffs include a single nerve cuff placed around the common peroneal nerve.

18. The fully implantable nerve stimulation system of Claim 9, wherein the one or more nerve cuff includes a single nerve cuff placed around the sciatic nerve.

19. An implantable system for treating foot drop comprising:

a control unit that is implanted in the body, the control unit including:

an electrical power source;

a processor;

at least one signal conditioning circuit;

at least one nerve stimulation circuit; and

at least one nerve cuff having electrodes therein that detect signals from and/or deliver a stimulation pulse to a nerve fiber;

wherein the processor in the control unit detects physiological event signals from the processed nerve signals produced by the at least one signal conditioning circuit and delivers a stimulation pulse to an electrode upon detection of a physiological event.

20. The implantable system for treating foot drop of Claim 19, wherein the control unit further comprises:

an accelerometer that produces signals indicative of the angle of a patient's thigh and wherein the processor adjusts the power drawn from the electrical power source in response to the thigh angle.

21. The implantable system for treating foot drop of Claim 20, wherein the processor adjusts the stimulation pulse delivered to the electrode in response to the thigh angle.

22. The implantable system for treating foot drop of Claim 19, wherein the control unit further comprises:

a programmable switch that is controlled by the processor to selectively couples a signal conditioning circuit to an electrode.

23. The implantable system for treating foot drop of Claim 20, wherein the processor enables the at least one signal conditioning circuit periodically when the patient's thigh angle is horizontal.

24. The implantable system for treating foot drop of Claim 20, wherein the processor enables the at least one signal conditioning circuit more frequently when the patient's thigh angle is vertical.

25. An implantable circuit for correcting foot drop comprising:

one or more nerve cuffs including a number of electrodes to be placed around a nerve for sensing nerve signals and/or for delivering stimulation pulses to a nerve;

an implantable event driven control unit including:

a source of electrical power;

a processor;

a sensor for producing a signal indicative of an angle of a patient's thigh;

a number of signal conditioning circuits that are selectively connectable under control of the processor to one or more electrodes to process nerve signals;

at least one nerve stimulation circuit that is selectively connectable to an electrode to deliver a stimulation pulse to the nerve;

wherein the processor is programmed to operate in a plurality of modes that are dependent in part on the sensed angle of the patient's thigh.

26. The implantable circuit of Claim 25, wherein the processor is programmed to reduce power drawn from the source of electrical power when the angle of the patient's thigh is sensed to be substantially horizontal.

27. The implantable circuit of Claim 25, wherein the processor is programmed to detect heel contact or toe lift events from sensed signals on a nerve when the sensed angle of the patient's thigh indicates the patient is standing.

28. The implantable circuit of Claim 27, wherein the processor is programmed to detect heel contact or toe lift events with processed nerve signals produced by the signal conditioning circuits and processed nerve signals that have been filtered.

29. The implantable circuit of Claim 28, wherein the processed nerve signals are filtered with a morphological filter.

30. The implantable circuit of Claim 25, wherein the processor is programmed to adjust the stimulation pulse delivered to a nerve as a function of the sensed angle of the patient's thigh.

31. The implantable circuit of Claim 25, wherein the source of electrical power is a battery.

32. The implantable circuit of Claim 31, wherein the battery is rechargeable.

33. The implantable circuit of Claim 25, wherein the control unit further includes a communication circuit that communicates with an external programmer to adjust the operation of the processor.

34. The implantable circuit of Claim 33, wherein the external programmer can adjust which electrode a signal conditioning circuit is connected to and which electrode receives a stimulation pulse.

35. The implantable circuit of Claim 25, wherein the processor is programmed to disable the number of signal conditioning circuits when a stimulation pulse is being delivered to an electrode.

36. The implantable circuit of Claim 25, wherein the processor is programmed to periodically enable the one or more signal conditioning circuits wherein the sensed angle of the patient's thigh is substantially horizontal.

37. An implantable circuit for delivering stimulation signals to a patient's muscle, comprising:

one or more nerve cuffs including a number of electrodes to be placed around a nerve for sensing nerve signals and/or for delivering stimulation pulses to a nerve;

an implantable event driven control unit including:

a source of electrical power;

a processor;

a number of signal conditioning circuits that are selectively connectable under control of the processor to an electrode to process nerve signals;

at least one nerve stimulation circuit that is selectively connectable to an electrode to deliver a stimulation pulse to the nerve;

wherein the processor is programmed to operate in a user initiated exercise mode such that stimulation signals are delivered to a nerve signal for a period of time to exercise the patient's muscle.